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DEPARTMENT OF AGRICULTURE.

GREY SPECK DISEASE OF WHEAT AND OATS

(known as White Wilt in Western Australia).

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During the past year, and for the first time in Australia, this disease has been independently identified both in this State and in South Australia.

It is a well-known disease on the Continent of Europe, where it receives the name of "Grey Speck" disease of oats. In this State it has been known as "White Wilt," and in South Australia as "Roadside Take-all."

The attention of this Department was first drawn, in 1922, to the disease at Dwarda by Mr. A. T. O'Connell, who recognised that it was different from the yellowing caused by excessive water and nitrate starvation in wet soils. Mr. O'Connell has since then each year carried out a series of experiments in conjunction with this Department. His interest in the problem and his attention to detail in carrying out the experiments, and in observing the results have alone rendered the field work possible. The information from which this article has been prepared has largely been gathered at Dwarda. At the same time no evidence has come to hand to indicate that the disease may occur elsewhere under other conditions.

So far as known, the disease is confined to Great Southern Districts extending from about Beverley to Broome Hill in the south, to Kulin and Moulyinning in the east, and westward from Narrogin to the Darling Range.

It is associated with Brown Mallet (*Eucalyptus astringens*) and Wandoo (*E. redunca* var. *elata*), and in the writer's opinion is closely related to the distribution of the former. It would appear probable that Mallet is a disappearing species, and that the occurrence of the disease beyond the present range of Mallet (as at Beverley) is connected with its previous wider range. Wandoo is not definitely linked with the disease, having a range far beyond that of Grey Speck. The present association of the disease with Wandoo would appear to be related to soils on which the latter has replaced Mallet.

Relation to Soils.

Grey Speck is associated with Mallet and Wandoo, or with Wandoo in Mallet areas. It occurs principally on gravelly hill-sides in which the ironstone gravel is associated with a light, floury, grey, loamy soil. In places, though less affected, this light floury soil is practically free from gravel. Mallet on the affected areas is associated with ridges with a lateritic (?) cap which weathers readily and easily breaks down into the floury soil and gravel. Where the cap has been denuded, Wandoo occupies the ground, but the gravelly soil is similar to that below the mallet ridges. Grey Speck has not been noted on alluvial soils such as river flats or on lower slopes except in conjunction with the gravel or lateritic (?) outcrops.

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The origin of this laterite (?) is unknown. It is quite distinct from that of the Darling Range.

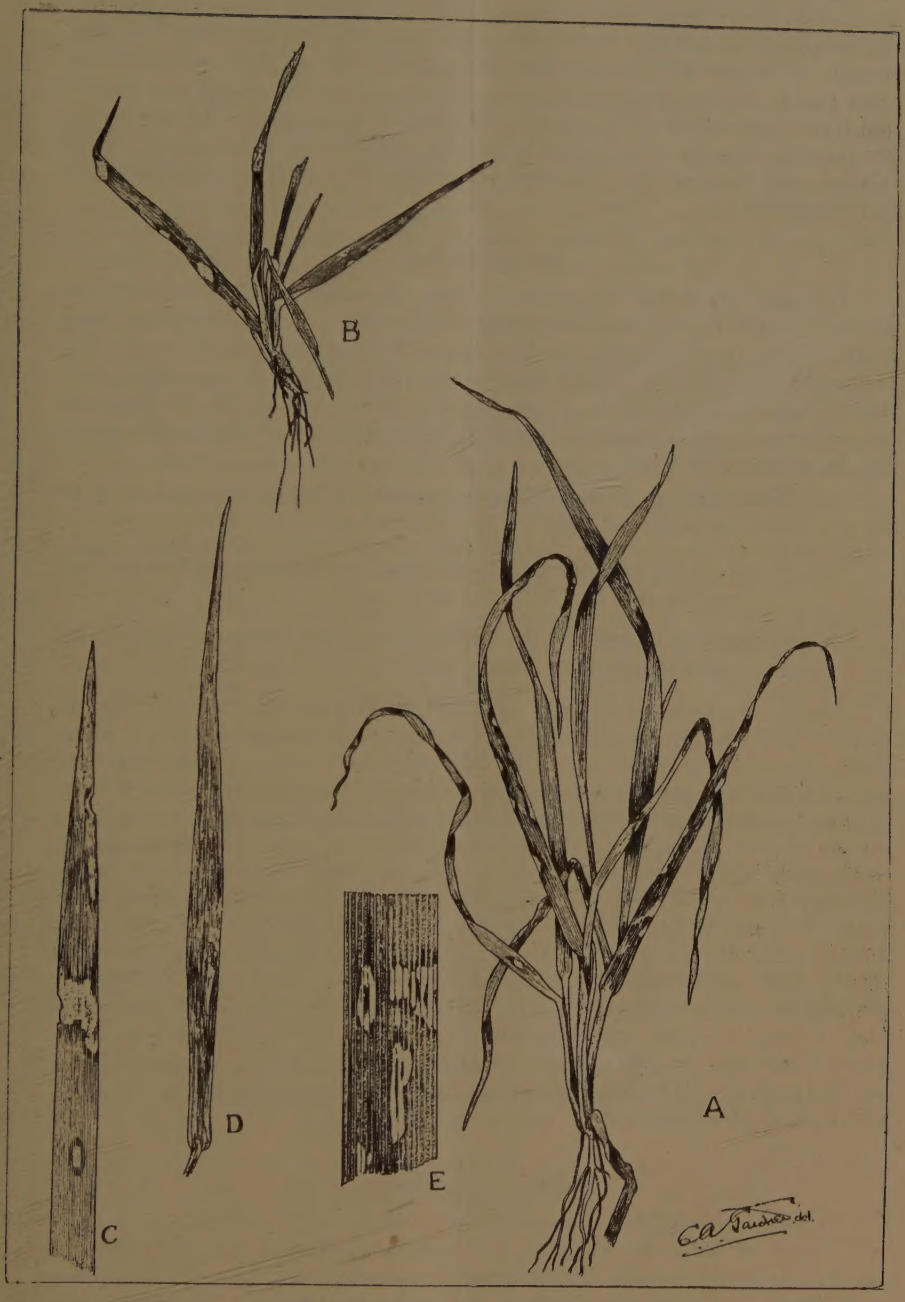
Chemically the soils are poor but are notable for the relatively high content of calcium carbonate and their alkalinity when dry in the summer (pH. ranging from 6.4 to 9.5). After the winter rains they become slightly acid. The soils in the area are very variable, and those mentioned are interspersed with granitic types. Those liable to the disease carry good pastures of annual clovers and grasses after cropping, and make good sheep country. They give good hay crops in the seasons when the disease is not severe.

Symptoms.

The disease makes its appearance in June or July, appearing as stunted yellowish or whitish patches in the young crops. These patches start from centres and may not extend individually over more than two or three square yards. In other seasons these may enlarge and run together to cover areas of several acres and upwards. The uncertainty of predicting the exact location of the trouble has been a factor causing difficulties in experimental work. In field experiments it has been overcome by using narrow plots upwards of 12 chains long, which ensured that whatever the seasonal occurrence, affected areas would somewhere cross the treated and control plots. Under normal seasons, about the end of August the affected patches show signs of improvement and then rapidly recover, yielding almost normal crops. In severe cases the plants may be too affected to recover; this applies more to wheat than oats. Should the season of recovery coincide with a droughty period, the affected areas may fail completely. There is no doubt that the disease looks more serious than it really is. Seen at its worst, an absolute failure of the affected areas would appear inevitable. Yet in good seasons it may be almost impossible to detect these areas a month or two later. It would appear that in Europe and in South Australia the trouble is more serious, and that without special treatment crop failure is normal.

Viewed superficially, Grey Speck may be confused with the yellowing which occurs in low waterlogged places due to nitrate and oxygen starvation of the roots. Grey Speck, however, has not been associated with wet land, and test drains put in by this Department showed neither evidence of need of drainage nor any beneficial result therefrom. The occurrence of both diseases has been noted in the same paddock, but while Grey Speck occurred on the slopes, waterlogging occurred on the lower and more level land.

Close examination of the affected plants, especially in the early stages of the disease, soon discovers definite and distinctive symptoms by which it may be recognised. While the first seedling leaf is a normal green, later leaves are a faintly yellowish green when they first show, the difference being readily detected by comparison. Somewhere about the centre, usually about the natural bend of the third leaf blade, spots appear. These are light coloured with a pinkish tinge, but later develop grey centres. In oats the lesions may be surrounded by a purplish margin. The spots start both at the edges and in the centres of the leaf blades and extend until they meet across the leaf, forming a dead irregular grey band while the blade at both ends is still green. The leaf collapses at the dead area and the upper half hangs down. The dead area extends and shrivels and the balance of the leaf turns yellow and then greyish-white as it dies. The spots are not confined to



Grey Speck on Algerian Oats.

A-B affected seedlings. C-E Details of leaf lesions.

one point, but may also develop above and below the main lesions. By this time other leaves have become diseased and the affected plants develop the characteristic appearance which has earned the name "White Wilt." Examination of numerous seedlings indicates that in the majority of cases the third leaf is the first to show the lesions, followed by the second and fourth, and then the first and fifth, and then in order of appearance. As new leaves are formed, they are affected and eventually killed, so that the plants remain stunted until they recover with warmer weather in August and September or fail altogether.

Investigations.

It is not intended in this paper to cover the experiments in the field and in pots, or the laboratory investigations which have been undertaken since 1922. These were started by Mr. Baron-Hay in conjunction with Mr. O'Connell. In 1925 the subject came under the attention of the writer, who has carried on investigations as opportunity offered and within the limits of his equipment. As a result of field tests it has been found that good control can be obtained by using—

1. Iron sulphate as a dressing on affected areas at the rate of 4 to 5 cwts. per acre.

2. Finely ground sulphur applied to soil two months before sowing at the rate of 2 cwt. per acre; and

3. Manganese dioxide 72 lbs. plus sulphate of ammonia 56 lbs. per acre applied at sowing time.

Nearly as good results were obtained when iron sulphate 112 lbs. or sulphur 112 lbs. was substituted for the sulphate of ammonia in 3. Manganese dioxide used alone in varying quantities gave only a partial improvement. Other field experiments showed no control from the use alone of lime, organic manure, nitrate of soda, sulphate of ammonia, gypsum, and as previously stated, drainage. Pot experiments, covering a greater range of treatments, in the main confirmed those in the field, excellent results being obtained from manganese dioxide plus sulphate of ammonia, which gave results superior to any other treatment. Manganese sulphate and manganese dioxide alone did not give satisfactory results. The former, which has come into general use in Europe for this disease, is there considered superior to the dioxide, but is much less readily obtainable here at present. Unfortunately it was not tried with sulphate of ammonia but with nitrate of soda which latter did not give the results obtained with sulphate of ammonia in any of the tests. 90 lbs. superphosphate is normally used per acre at Dwarda, and equivalent amounts were used in all experiments.

Cause of the disease.

It would appear that a deficiency of available nitrogen and some chemical defect of the soil associated with calcium salts and low temperatures are primarily responsible. This defect is overcome by the use of sulphur, sulphate of iron and manganese dioxide. Several theories have been proposed in Europe, but a more satisfactory explanation may be found in results obtained by Messrs. Samuels and Piper at the Waite Agricultural Research Institute in South Australia this year. These indicate that the primary soil defect is a lack of available manganese, though the soils are not deficient in this element. The writer was fortunately able to see something of these experiments, and was able to confirm the identity of the

disease in the two States. As the Waite Institute is carrying on the research, no further detailed investigations will be attempted here. It is, however, proposed next season to test manganese sulphate plus ammonium sulphate as a dressing on affected areas after the disease appears.

The solution of the cause of the disease, and how it operates, will probably take longer than to find an effective control. The writer has had some evidence that the lesions are due to bacteria attacking plants in an unhealthy condition as a result of the soil defects. Tests with bacteria isolated from the leaf lesions indicated that infection occurred from drops of water collecting between the partially unfolded and the folded leaves of the growing point. These tests require confirmation.

Control Recommendations.

The opportunity arose at Dwarda of comparing the incidence of the disease in one crop on affected land sown to cereals, two, four and six years before in adjoining blocks. The disease had led to portion of the paddock being withdrawn from cultivation in 1921, and an extension of this area in 1923, the balance being cropped and diseased in 1925. In 1927 the whole area was cropped and the disease, though occurring throughout, was distinctly less marked in the areas not cultivated in 1925. It would appear that, pending the final solution of the problem, it would be advisable to crop the affected areas not more than once in four years.

The chemical treatments, so far found successful, are too expensive, taking into consideration the value of the land concerned and the uncertainty of crop failure on affected areas. For instance, the affected areas at Dwarda, 1927, all gave good crops.

Summary.

White Wilt of wheat and oats in Western Australia is identical with the Grey Speck Disease of oats in Europe and the Roadside Take-all of South Australia.

In this State it is associated with Brown Mallet or Wandoo in Mallet country. The disease appears as yellow or whitish patches on hillsides. These are first noticeable in June or July. By the end of August or early September the affected areas either recover and produce nearly normal crops or fail. Failure depends upon unsuitable climatic conditions for growth in August and September.

The disease has been experimentally controlled by certain chemical treatments. It is possible that some such treatment may be found which will be economically justified.

For the present the evidence available indicates that cropping not more than once in four years causes a definite reduction of the disease.

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